Dwarf Mistletoe
Loss Assessment Survey
in Region 4, 1978

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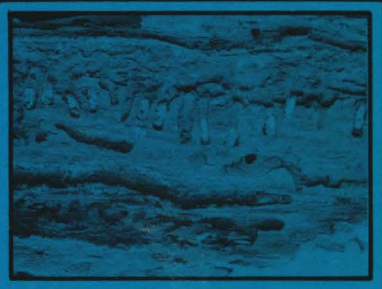

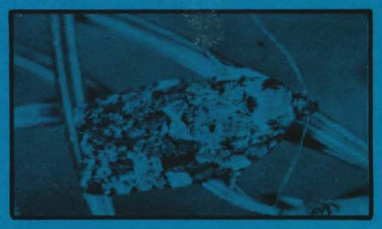

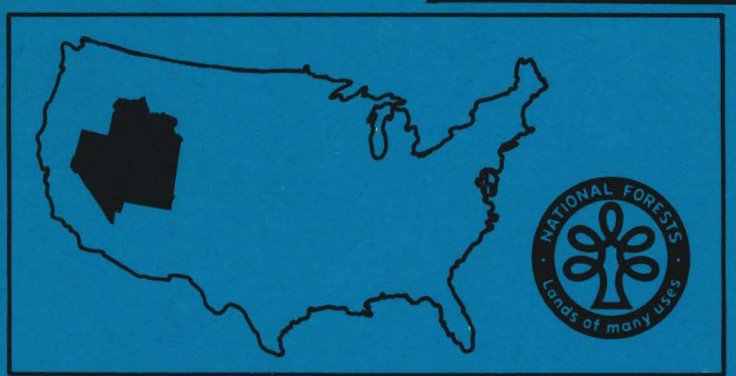

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DWARF MISTLETOE
LOSS ASSESSMENT SURVEY
IN REGION 4, 1978

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DWARF MISTLETOE LOSS ASSESSMENT SURVEY IN REGION 4, 1978[1/]

INTRODUCTION

A survey was conducted to provide more accurate, updated estimates of the incidence and annual cubic-foot volume loss due to dwarf mistletoes (Arceuthobium spp.) on Region 4 Forests. The information available in the current forest timber inventory is inadequate (Johnson, 1978). Therefore, the intent of the survey was to provide the land manager with an interim approximation of dwarf mistletoe incidence and growth loss. The basis for this study was a previously developed roadside and plot survey (Drummond, 1978).

OBJECTIVES

The objectives of the dwarf mistletoe loss assessment survey were to estimate both incidence of and cubic-foot volume loss due to lodgepole pine dwarf mistletoe (Arceuthobium americanum Nutt. ex Engelm.). In addition, incidence and intensity information was collected on ponderosa pine dwarf mistletoes (A. campylopodum Engelm. and A. vaginatum subsp. cryptopodum (Engelm.) Hawks. and Weins), and Douglas-fir dwarf mistletoe (A. douglasii Engelm.).

METHODS

General

The survey consisted of two parts. First, a roadside reconnaissance was made along all passable roads on selected National Forests. This provided dwarf mistletoe incidence and intensity information as well as general stand data. Secondly, to quantify the loss assessment, temporary fixed and variable plots were established every three miles of roadway travelled.

No attempt was made to differentiate ownership or stand utilization components (productive or unproductive sites) within the boundaries of the National Forests that were surveyed.

Roadside Survey

The survey procedure required two-person crews in pickup trucks to review a one-chain-wide strip along the right side of the vehicle while traversing the roads at speeds of less than 10 miles per hour.

1/ Prepared by: Jim T. Hoffman, Plant Pathologist and LaGrande Hobbs, Plant Pathologist, Forest Insect and Disease Management, State and Private Forestry, USDA Forest Service, Ogden, Utah.

Mileage, to the nearest 1/10 mile, was recorded at any point where there was a detectable change in stand type, size class, or dwarf mistletoe infection levels. The stand size classes were recorded as merchantable (M - greater than 8.0 inches dbh), poles (P - 5.0 - 7.9 inches dbh), or seedling/sapling (SS - less than 4.9 inches dbh).

Dwarf mistletoe infection intensity was recorded as 0, 1, 2, or 3. "0" equals no infection, "1" equals less than 1/3 of the trees in the stand's predominant size class were infected, "2" represents 1/3 - 2/3 of the predominant trees were infected, and "3" is greater than 2/3 of the stand's predominant class with infections. A roadside survey data sheet is included in the Appendix.

Plot Survey

The second part of the loss assessment survey consisted of the establishment of a variable-radius (BAF 10) and fixed-radius (11.8 ft.) plot at intervals of three miles in the roadside survey. These plots were located two chains into the forest from the roadside and at right angles to it. The primary direction for the plot was to the right side of the road, but if that direction resulted in a nontype plot, then the left side was used. If both sides were nontype, the plot was recorded as being nontype and discarded without replacement.

On each "type" plot the site index was taken. The other information collected on the variable plot included dbh, height, species, dwarf mistletoe rating (Hawksworth, 1977), and condition live or dead.

Information on saplings less than five inches dbh but taller than five feet, and seedlings, was collected from the fixed-radius (1/100 ac) plots. This data included dbh, species, dwarf mistletoe rating, and condition live or dead. A plot survey data sheet is included in the Appendix.

Data Processing

The roadside survey data was used to determine the percentage of different timber types and stand sizes with specific levels of dwarf mistletoe infections. This was done by determining the ratio of miles of tree species with dwarf mistletoe infections to the total number of miles of that species type traversed.

The data from the plot surveys was used to obtain the dwarf mistletoe incidence and cubic-foot volume loss assessment. Personnel from the Methods Application Group (Washington Office, Forest Insect and Disease Management, Davis, California) transposed the plot survey data to processing equipment for summarization and incorporation into a stand simulation program (RMYLD).

Scope

Eight of the 16 National Forests in Region 4 were surveyed under contract by Meiiji Resource Consultants of Bountiful, Utah. They included the Ashley, Bridger-Teton, Caribou, Fishlake, Manti-LaSal, Targhee, Uinta, and Wasatch National Forests.

The Boise, Payette, Salmon, Sawtooth, and Toiyabe National Forests were surveyed with Forest Service force account summer crews.

Expenses relative to the survey and a cost comparison of the two survey crews are presented in the Appendix.

RESULTS AND DISCUSSION

Tables 1, 2 and 3 summarize different aspects of dwarf mistletoe impact on lodgepole pine stands in Region 4. This information was collected from the 1978 plot surveys. The effects of dwarf mistletoe in reducing tree growth and in increasing mortality over time were derived by using the RMYLD stand simulation model.

Dwarf mistletoe is a common component of lodgepole pine stands in Region 4 (Table 1). It was found in 60% of the plots that were surveyed. Moreover, the parasite causes significant annual cubic-foot volume losses (Table 1). On a National Forest basis, the amounts of the volume loss vary from a low of about 1.4 million on the Payette National Forest to a high of over 6 million cubic feet on the Targhee National Forest. To make the Forest figures comparative, the annual cubic-foot loss was divided by the acres of lodgepole type on each Forest. This results in ft^3/acre/year (Table 1).

The facts in Table 1 indicate that dwarf mistletoe causes the least amount of growth loss on the Wasatch National Forest (3.9 ft^3/acre/year) and the most on the Sawtooth (21.6 ft^3/acre/year). It is present in 79% of the lodgepole stands on the Targhee National Forest.

It is interesting to note that percent incidence and growth loss by acre of lodgepole pine type are not necessarily related.

Other aspects of the "bottom line" figures in Table 1 are presented in Tables 2 and 3. Acres of infection and the ft^3/year volume loss by the 6-class mistletoe severity categories are contained in Table 2. Table 3 quantifies the incidence and volume loss information by timber size classes.

Information in Table 2 shows that on a Regional basis over 59% of the volume loss occurs on less than 13% of those infected acres in the 5.1 - 6.0 severity class. This would suggest that most of

this highly infected acreage is in mature to overmature stands because dwarf mistletoe intensity increases an average of one severity class every 15 years (Hawksworth, 1964).

Support for this idea comes from a breakdown by size class of the incidence and volume loss information (Table 3). Dwarf mistletoe in sawtimber accounts for the majority of the total volume loss. However, with the exception of the Bridger-Teton National Forest, a considerable percentage of the pole-sized area is dwarf mistletoe infected. This implies that as these stands approach rotation the already high levels of mistletoe incidence will spread both laterally and in intensity.

The increase in dwarf mistletoe will result in significant volume reductions in the current pole-sized stands of lodgepole pine over their rotation. The losses will be greatest on the Boise, Caribou, Salmon and Targhee National Forests. The future volume loss due to dwarf mistletoe on these Forests should exceed the present levels.

The roadside survey, furnishing information on the incidence of dwarf mistletoe by host species, is summarized in Table 4. The incidence information of lodgepole pine dwarf mistletoe was presented previously but is included again for comparison with the other tree species and with Table 1.

There is a considerable discrepancy for lodgepole pine between the 46% Regional incidence in Table 4 and the 60% incidence in Table 1. This is because the Fishlake, Manti-LaSal, Toiyabe and Uinta National Forests have little acreage in lodgepole pine type and were excluded from Table 1 but were included in Table 4 to obtain the Regional average.

Many of the "0" figures in the ponderosa pine and Douglas-fir categories are also an artifact of Regional averaging. In most cases, where an 0 is present in a species category, there is little or no forest acreage of the species on that National Forest. Therefore, the Regional average figures in Table 4 for incidence of dwarf mistletoe are 10 to 20% less than they should be if only total forest acreage were considered.

Much of the dwarf mistletoe problem in Region 4 has been aggravated by past cutting and fire protection practices. Responsible management decisions that consider the effects of this disease could keep the productive stands in Region 4 in a healthy and vigorous condition.

SUMMARY

A survey of incidence of and growth loss caused by dwarf mistletoes was made on 13 of the 16 National Forests in Region 4 in 1978. The study consisted of a roadside and plot survey.

The survey results emphasize the magnitude of the dwarf mistletoe problem in lodgepole pine stands throughout the Region. An average of 60% of the lodgepole pine is infected resulting in a total volume loss of 28,500,000 cubic feet per year.

Most of the growth loss occurs in mature and overmature stands. On some Forests, a substantial amount of the parasite is in pole-sized timber but at the present there is little growth loss.

Information on the presence of dwarf mistletoes in ponderosa pine and Douglas-fir stands was also collected. Some Forests have up to 65% of the ponderosa pine and 80% of the Douglas-fir infected. Research is needed to quantify the volume loss caused by the incidence of these mistletoes.

Table 1. Incidence and cubic-foot volume loss estimates due to dwarf mistletoe on lodgepole pine stands in Region 4. Information based on 1978 plot survey and the RMYLD simulation model.

National Forest[1/]	Number of Plots Established Within LPP Type	Percent of Lodgepole Pine Plots With Dwarf Mistletoe	Annual Cubic-Foot Volume Loss Due to Dwarf Mistletoe	Annual Cubic-Foot Volume Loss Per Acre of LPP Type
Ashley	31	58	3,304,455	7.6
Boise	17	57	1,598,052	6.7
Bridger-Teton	30	67	3,491,856	7.9
Caribou	19	68	2,290,318	7.3
Payette[2/]	6	50	1,460,868	7.7
Salmon	34	59	4,965,080	11.1
Sawtooth[3/]	7	71	3,798,757	21.6
Targhee	58	79	6,066,900	7.2
Wasatch	41	34	1,600,066	3.9
TOTAL	243		28,576,352	
AVERAGE		60.3		9.0

1/ The Humboldt, Toiyabe, Fishlake, Dixie, Manti-LaSal, and Uinta National Forests have little or no forest acreage in the Lodgepole Pine type and thus are excluded from this table. The Challis National Forest was not surveyed.

2/ Few plots were established because of relatively little LPP type.

3/ From Burley and Twin Falls Districts only.

Table 2. Acres of infections and annual cubic-foot volume loss estimates in thousands for Region 4 lodgepole pine stands by the 6-Class dwarf mistletoe severity categories.

Dwarf Mistletoe Severity Category	Ashley N.F.		Boise N.F.		Bridger-Teton N.F.		Caribou N.F.		Payette N.F.		Salmon N.F.		Sawtooth N.F.		Targhee N.F.		Wasatch N.F.		Total	
	M Acres	M Ft^3/yr	M Acres	M Ft^3/yr	M Acres	M Ft^3/yr	M Acres	M Ft^3/yr	M Acres	M Ft^3/yr	M Acres	M Ft^3/yr	M Acres	M Ft^3/yr	M Acres	M Ft^3/yr	M Acres	M Ft^3/yr	M Acres	M Ft^3/yr
0	184	0	126	0	148	0	97	0	97	0	185	0	50	0	175	0	273	0	1,335	0
0.1-1.0	42	0	42	0	15	0	32	0	*	*	53	132	25	0	117	0	41	0	367	132
1.1-2.0	56	0	*	*	15	15	32	0	*	*	26	0	25	0	102	0	10	0	266	15
2.1-3.0	*	*	*	*	118	387	16	129	64	64	13	26	*	*	117	233	10	10	338	849
3.1-4.0	56	847	28	252	44	577	65	1,306	*	*	66	687	*	*	175	1,020	20	152	454	4,841
4.1-5.0	42	241	42	1,346	30	518	48	629	*	*	39	1,070	*	*	58	1,736	20	365	279	5,905
5.1-6.0	56	2,217	*	*	74	1,997	16	225	32	1,397	66	3,050	76	3,799	102	3,077	41	1,073	463	16,835
TOTAL	438	3,304	238	1,598	444	3,492	306	2,290	193	1,461	448	4,965	176	3,799	846	6,067	415	1,600	3,504	28,576

* indicates no stand plot averages were summarized for that category.

Table 3. Dwarf Mistletoe incidence and volume loss estimates for lodgepole pine stands in Region 4 by size class and National Forest

	NATIONAL FOREST								
	ASHLEY	BOISE	BRIDGER-TETON	CARIBOU	PAYETTE	SALMON	SAWTOOTH	TARGHEE	WASATCH
% of Area Surveyed in Poles[1/]	19	18	10	21	0	29	0	38	27
% of Area Surveyed in Sawtimber[2/]	81	82	90	79	100	71	100	62	73
% Pole Area with DM Infections	33	67	0	50	0*	40	0*	82	27
% Sawtimber Area With DM Infections	64	43	74	67	50*	67	71*	78	37
Annual Ft^3 Volume Loss Per Acre of Pole Area	2.33	1.00	0	6.00	0*	11.10	0*	6.91	0.09
Annual Ft^3 Volume Loss Per Acre of Sawtimber Area	10.20	7.93	8.74	9.47	7.67*	11.21	21.56*	7.42	5.23
Total of Annual Cubic Foot Vol. Loss Per Acre of LPP Type	7.55	6.70	7.86	7.27	7.67*	11.06	21.56*	7.17	3.85

1/ Pole = 5.0 to 7.9 inches dbh.
2/ Sawtimber = Greater than 8.0 inches dbh.
* Few plots were established and the category needs further investigations.

Table 4. Incidence of lodgepole pine, ponderosa pine, and douglas-fir dwarf mistletoes by percent in 13 National Forests in Region 4.

SPECIES	Ashley	Boise	Bridger-Teton	Caribou	Fishlake	Manti-LaSal	Payette	Salmon	Sawtooth	Targhee	Toiyabe	Uinta	Wasatch	Average for the Region
Lodgepole Pine	58	57	67	68	0	0	50*	59	71*	79	17*	38*	34	46
Ponderosa Pine	8	65	0	0	66	34	64	57	14	0	35*	0*	0	26
Douglas-fir	21	78	17	21	24	0*	80	49	53	55	25*	0*	9	33

*Indicates that little of the species type was surveyed and the category needs further investigation.

REFERENCES

Drummond, D.B. 1978. Approaches to determining volume losses due to dwarf mistletoe on a westwide basis. In Dwarf mistletoe control through forest management. Symp. Proc. Berkeley, CA., Scharpf, R.F. and J.R. Parmeter tech. coord. U.S.D.A. For. Serv. Rep. PSW-31.

Hawksworth, F.G. and T.E. Hinds. 1964. Effects of dwarfmistletoe on immature lodgepole pine stand in Colorado. J. For. 54:384-390.

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Johnson, D.W., F.G. Hawksworth and D.B. Drummond. 1978. 1977 Dwarf mistletoe loss assessment survey - Medicine Bow National Forest. U.S.D.A., For. Serv., State and Private Forestry, Methods Application Group, Davis, CA. Rep. 78-1.

APPENDIX

APPENDIX 1. 1978 Dwarf Mistletoe Survey Budget. Comparison of contract and force account crews.

CONTRACT CREW

Salaries - 4 crew members and a supervisor	$ 17,772
Per diem - 5 people @ $35/day x 60 days	10,500
Vehicles and maintenance	2,500
Supplies	1,300
Profit (15%) and overhead (10%)	10,690
TOTAL COST	$ 42,762
Miles surveyed	2,317 miles
Cost per mile	$18.46/mile

FORCE ACCOUNT CREW

Salaries:	
1 GS-11 @ 2 PP = $ 1,405	
2 GS-5's @ 7½ PP = 5,748	
2 GS-4's @ 7½ PP = 5,140	
TOTAL	$ 12,293
Per diem - $8.25 x 105 days x 4 people	3,465
Transportation	3,000
Supplies	1,500
Administrative overhead (GA)	3,110
TOTAL COST	$ 23,368
Miles surveyed	1,270 miles
Cost per mile	$18.40/mile

Total Miles Surveyed	3,587 miles
Total Cost (both crews)	$ 66,130

ROADSIDE SURVEY DATA SHEET

National Forest_____ Crew Init._____ Page___of_____ Pages

Ranger District_____ Date_____

Road Segment #_____ Beginning Point on Road Segment_____

Begin	End	Miles	Species					Size			Mistletoe				Remarks
			LPP	PP	DF	JP	Mix	SS	P	M	0	1	2	3	

PLOT SURVEY DATA SHEET

National Forest_____ Road Segment #_____ Crew Init._____

Ranger District_____ Plot #_____ Date_____

Starting Point of Rd. Segment_____ Location (to nearest 1/20 mile from starting point)_____

Site Index (Ht./Age x 100)_____ Age_____

Habitat Type

Tree No.	Variable Plot (BAF10)					Fixed Plot (0.01A)			
	DBH (in.)	Ht. ft.	Species	DMR	Cond. L. or D.	DBH	Species	DMR	Cond. L. or D.
1									
2									
3									
4									
5									
6									
7									
8									
9									
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